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IMPORTANT POULTRY DISEASES

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CHICKENS, turkeys, ducks, geese, and pigeons are susceptible to many diseases, some of which are highly infectious. Disease germs pass rapidly from bird to bird of the flock, and may be carried by one means or another to neighboring flocks, producing extensive outbreaks, or epizootics.

Certain diseases respond favorably to treatment. Others resist all efforts at treatment and cause very heavy losses.

Preventive measures properly applied offer the surest means of controlling diseases of domesticated birds.

It is necessary that the poultry owner be enlightened as to the characteristics of the more important diseases in order that he may intelligently use the most approved methods of combating them.

Sanitary and other measures which have been found successful in the control of poultry diseases may materially reduce the great annual losses in flocks if they are properly applied.

IMPORTANT POULTRY DISEASES.

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IMPORTANCE OF HEALTH IN POULTRY FLOCKS.

FOWLS are subject to a considerable number of diseases, some of which spread rapidly through the flock and cause a high mortality. They may also be infested by various kinds of parasites, some of which live on the surface of the body and others in the crop, stomach, or intestines. These parasites are injurious because they take a part of the nourishment which should be used by the bird to put on flesh or to produce eggs, and also because by their movements and their biting they cause irritation and inflammation of the parts which they attack.

The contagious diseases which are caused by animal and vegetable germs, and the weakness and loss of flesh caused by the larger parasites to which reference has just been made, are the most important conditions which the poultryman has to consider in the endeavor to keep his birds healthy. These germs and parasites should be kept out of the flock by suitable preventive measures, because disease may be avoided much more easily and cheaply than it can be cured. The aim in studying the diseases of poultry is, therefore, to learn how to prevent such diseases rather than how to cure them.

There are some cases in which medicines may be advantageously given or applied to fowls, but, as a rule, when a bird becomes sick it is better to kill it, because the cost of medicine and the value of the time required to carry out the treatment are greater than the value of the bird which is cured. Another reason for killing sick birds is that they may be affected by a contagious disease which before it

is recognized may spread to many other birds in the flock. A third reason for killing is the fact that a bird being sick indicates that it is more susceptible to disease than the other birds of the flock, and in order to establish a flock which is able to resist disease such susceptible birds must be eliminated.

The greater the number of birds kept upon any farm or plot of ground, and the more they are crowded together the greater is the danger from contagion and parasites, and the more important are the measures for excluding, eradicating, and preventing the development of these causes of disease.

HOW TO PREVENT DISEASE.

It is very important to start right and begin the flock with birds that are free from contagion and parasites, and to put such birds upon ground which is likewise free from these causes of disease.

The best way to accomplish this is to get eggs from a flock which has shown no indications of contagious disease for at least a year; avoid putting these eggs in any packing such as chaff, oats, or cut straw which may be musty or moldy; wipe the eggs with a cloth wet in 70 to 80 per cent alcohol, and hatch them in a new or thoroughly cleaned incubator. The young chicks should be free from parasites and injurious germs of all kinds, and to keep them in this condition they should be put into new or clean brooders and permitted to run only upon ground where poultry has not previously been kept or which has not been used for poultry for several years.

Sometimes these directions can not be followed in all respects. If all the available ground has been recently used for poultry, the fowls should be removed from that part which is to be used for the new flock, a good coating of freshly slaked lime should be applied to the entire surface of the ground, and a few days later it should be plowed. It may now be cultivated three or four times with intervals of a week and finally sowed with oats, rye, or other grain. In a few months the greater part of the germs will be destroyed; but it is best to leave the ground unoccupied by fowls until a winter has passed, as the freezing and thawing of fall and spring are more effective than either continued cold or warm weather.

If the eggs must be hatched under hens instead of in the incubator, the problem of starting a clean flock is much more difficult. Hens are liable to harbor parasitic worms in their intestines and to scatter the eggs of these worms with their manure wherever they go. They generally have lice and mites hidden in their feathers, which pass to the young chicks immediately after the latter are hatched; and they may be the carriers of disease germs even when they appear perfectly healthy. For these reasons the hens which are used for hatching should be selected from a flock that is known to have been

free from other diseases than those caused by accidents for at least a year, and the individual birds of which are lively, vigorous, free from lice and mites, and are producing a large number of eggs.

The hens selected for hatching should be well dusted with a good lice powder before they are given a setting of eggs; their nests should be perfectly clean and should be made with fresh, soft hay or straw; and there should be a box of road dust, or sifted hard-coal ashes, or similar substances, under cover, where they can dust themselves whenever they come from the nest. When the young chicks are taken from the nest they should be carefully examined for lice. These parasites usually accumulate under the throat and upon the top and back of the head. If any are found, rub a little sweet oil, pure lard, or vaseline with the finger over the parts where the lice are. This kills the lice by obstructing their breathing pores and does not harm the chicks.

By beginning in this manner a flock may be obtained which is practically free from disease germs and parasites, but in order to keep it in this condition the premises must be frequently cleaned and occasionally disinfected. There are a number of reasons for this. First, there are certain germs generally present in the intestines of healthy fowls that are scattered with the manure, and which, when they are permitted to accumulate and become very numerous, may cause outbreaks of disease; second, the germs of contagious diseases may be brought to the poultry yard by pigeons or other birds which fly from one poultry yard to another, or by mice or rats; third, it is seldom that ground is obtained for the poultry yard which is entirely free from infection with the eggs of parasitic worms and the spores of disease-producing microbes. To keep these germs and parasites from developing and increasing their numbers to a dangerous extent the houses should be kept clean, the drinking fountains and feed troughs should be washed every week with boiling water or other disinfectant, and, if any lice or mites are found on the birds or in their houses, the roosts and adjoining parts of the walls should be painted with a mixture of kerosene, 1 quart, and crude carbolic acid or crude cresol, 1 teacupful (1 gill). Or the house may be whitewashed with freshly slaked lime or sprayed with kerosene emulsion. The fowls should be dusted with lice powder.

DISINFECTANTS AND THEIR APPLICATION.

Good disinfectants destroy the germs of contagious diseases, the external parasites, such as lice and mites, and in some cases the eggs of parasitic worms. The eggs of some kinds of worms are so resistant that disinfectants other than heat have little effect upon them. The disinfectants should be thoroughly applied to the interior of

the houses, worked into all the cracks and crevices, spread over the ceiling and the floor, the roosts, dropping boards, and nest boxes. At the same time the feeding and drinking troughs should be disinfected by pouring boiling water into them and afterwards drying them in the sun. Disinfectants are most easily applied to the walls and ceilings with a spray pump or by using a brush. As it is difficult to keep them from coming into contact with the face and hands, the more harmless of these mixtures should generally be used. Ordinary limewash made from freshly slaked lime is excellent, and its properties are well known to all. In the case of an actual outbreak of virulent disease it is well to add to the limewash 6 ounces of crude carbolic acid to each gallon, to increase its activity as a disinfectant.

The kerosene emulsion, which is frequently used to destroy mites, may readily be converted into a disinfectant. To make the emulsion, shave half a pound of hard laundry soap into half a gallon of soft water and boil the mixture until all the soap is dissolved, then remove it to a safe distance from the fire and stir into it, at once, while still hot, 2 gallons of kerosene oil. This makes a thick, creamy emulsion, or stock mixture. When it is to be used for killing mites in the houses, 1 quart of this emulsion is mixed with 10 quarts of water. When it is to be used as a disinfectant, stir well, then add 1 pint crude carbolic acid or crude cresol, and again stir until all is well mixed.

The compound solution of cresol is one of the best disinfectants which may be purchased ready for use. It contains 50 per cent of cresol, and 1 pint of it added to 10 quarts of water makes a solution of the proper strength to apply to the houses or to spray over the ground. A 5 per cent solution of carbolic acid (1 pint carbolic acid to 10 quarts of water) is about equally efficacious. The choice between the two is a matter of convenience.

CONTAGIOUS CATARRH (ROUP).

The disease called "roup" by poultrymen is a contagious catarrh, closely resembling the more malignant forms of influenza in the larger animals and in man. It attacks principally the membranes lining the eye, the sacs below the eye (infraorbital sinuses), the nostrils, the larynx, and the trachea. It is attended with high fever and is very contagious. (Fig. 1.)

Causation.—Roup appears to be a strictly contagious disease; that is, one which arises only, so far as known, by contagion from other diseased birds. The nature of the microbe which constitutes the virus is not known. The contagion is generally brought into the poultry yard by infected birds. Sometimes these are birds which are purchased from other flocks in which the disease exists; some-

times they are birds of the home flock which have been in exhibitions and there exposed to sick fowls; and sometimes they are wild birds or pigeons which fly from one poultry yard to another.

The saliva and the discharge which escapes from the nostrils carry the contagion and soon contaminate the drinking water and feeding troughs so that all the fowls are infected. Even the flocks in adjoining yards are infected by the particles of mucus projected into the air when sneezing, or by the contagion carried on the feet of persons, animals, or small birds that pass from one yard to another.

Delicate birds are inclined to severe attacks and to recover slowly, and often a chronic condition persists for a long time. Birds so

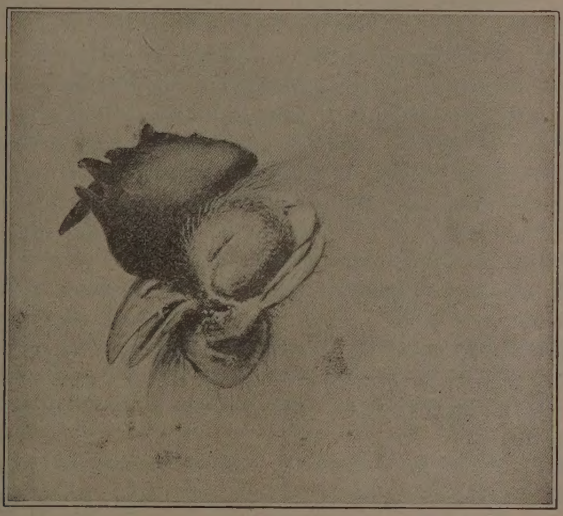

FIG. 1.—Head of fowl affected with contagious catarrh (roup), showing swelling of the eye.

affected may carry and spread the contagion for a year or more and become the cause of new outbreaks of the disease.

Symptoms.—The symptoms first seen are very similar to those of an ordinary cold, but there is more fever, dullness, and prostration. The discharge from the nasal opening is at first thin and watery, but in two or three days it becomes thick and obstructs the breathing. The inflammation, which begins in the nasal passages, soon extends to the eyes and to the spaces which exist immediately below the eyeballs (infraorbital sinuses). The eyelids are swollen, held closed much of the time, and may be glued together by the accumulated secretion. The birds sneeze and shake their heads in their efforts to free the air passages from the thick mucus. The appetite is diminished, and the

birds sit with their heads drawn in and their wings drooping, having a general appearance of depression and sickness.

When the inflammation reaches the spaces or sacs beneath the eyes it causes the formation of a secretion very similar to that of the nose, and as this becomes thick it collects, distends the walls of these spaces, and produces a warm and painful swelling, which is seen just below the eyes and may reach the size of a hickory nut. This swelling presses with much force on the eyeball, which is displaced and more or less deformed, and in extreme cases even the bones of the head may give way before it.

The closure of the eyes prevents the badly affected birds from finding food; the accumulation of mucus in the nostrils completely obstructs these passages, so that the beak must be kept open in order to breathe; the obstruction of the windpipe and the smaller air tubes causes loud breathing sounds and difficult respiration.

In the severe and advanced cases the birds sit in a somnolent or semiconscious condition, unable to see or to eat; their strength is rapidly exhausted, and many of them die within a week or 10 days. A part of the affected individuals recover, but others continue weak and have a chronic form of the disease for months, during which time they continue to disseminate the contagion.

This disease is distinguished from diphtheria by the absence of the thick, tough, and very adherent newly formed membranes (false membranes) in the nostrils, mouth, and throat which are characteristic of the latter. There may sometimes be a deposit of yellowish material on the walls of the mouth and throat, but it is easily broken up and removed.

Treatment.—The medical treatment of this disease may be very successful if properly applied. The sick birds should be removed from the flock and put into a warm, dry, and well-ventilated room which is free from drafts. The affected mucous membranes should then be treated by applying antiseptic and healing mixtures. The best method is to use a good spraying apparatus, but, lacking this, a small syringe, an oil can, or even a medicine dropper can be made to answer the purpose, or the bird's head may be plunged into a basin or bowl of the mixture and held there a few seconds, but not long enough to cause suffocation.

The remedies most suitable for such treatment are: Boric acid, 1 ounce; water, 1 quart. Or, permanganate of potash, 1 dram; water, 1 pint. Or, boric acid, 1¼ ounces; borate of soda, ½ ounce; water, 1 quart. Or, peroxid of hydrogen, 1 ounce; water, 3 ounces.

Where the inflammation has progressed to the eye, excellent results have followed the use of argyrol. One or two drops of a 15 per cent solution is introduced between the eyelids twice daily for a period of several days.

Before applying these remedies it is well to wash the eyes and mouth with warm water containing 1 teaspoonful of common salt to a quart, using a pledget of absorbent cotton and rubbing gently, while at the same time pressing and massaging about the nostrils and under the eyes to loosen the accumulated secretion. If there is much swelling under the eyes it must be carefully opened with a sharp, clean knife, all the secretion removed, and the cavity washed with one of the above-mentioned solutions. A pledget of cotton moistened with the solution may be left in the opening for an hour or two, or it may be dusted with iodoform powder. When the swelling under the eye is not very large or hard it may often be reduced by massaging it in such manner as to press the contents toward the nostril. After treating the birds in this manner the head should be well anointed with pure vaseline or with camphorated vaseline.

The treatment of sick birds requires much time and patience, and there is always the risk that they may carry the contagion for several months after they are apparently well. Prevention is therefore much more profitable. To accomplish this, measures should be continually enforced which will exclude contagion of all kinds. New birds and those which have been in exhibitions should be isolated and kept under observation for two weeks before they are put with the flock, and all animals and wild birds excluded, so far as possible. The houses should be kept clean and dry and occasionally disinfected. If the disease appears notwithstanding these precautions, isolate the affected fowls at once at a distance from the well ones and apply disinfectants freely about the houses and runs. Also place sufficient permanganate of potash in all drinking water to give the latter a deep purple color. If the disease proves of a severe type it is often better to kill the entire flock, and after a thorough cleaning and disinfection of the premises to begin with new birds. This radical method avoids the retention of birds which may harbor the contagion and cause the development of subsequent outbreaks.

DIPHTHERIA.

Diphtheria is a disease having some of the symptoms of a cold, or of the contagious catarrh described above, but which differs from these and is especially characterized by the development of false membranes on the mucous surface of the nostrils, eyes, mouth, throat, and even of the smaller air tubes. The false membranes are exudates of a grayish or yellowish color, very tough, and very difficult to remove from the tissues beneath them. (Fig. 2.)

Causation.—The diphtheria of fowls is caused by a filterable and invisible virus, and therefore is entirely distinct from the diphtheria of man, which is caused by a well-known bacillus. The disease is strictly contagious and probably never develops as the result

of exposure to cold and dampness, although these conditions favor its spread and tend to increase its malignancy. The contagion is generally introduced by newly purchased birds or by birds which have been in exhibitions and there exposed to sick fowls. Sometimes it is carried by pigeons and other small birds. Very often an outbreak is caused by contagion from an apparently well bird which had the disease and recovered months before.

The contagion is spread through the mucus which escapes from the nostrils or that which is forced out in the acts of sneezing or

FIG. 2.—Fowl diphtheria. Neck slit open to show diphtheritic patches in mouth and esophagus. (After Rätz.)

coughing, in the saliva, the secretions of the eyes, and also the excrement. When the disease appears in a flock the floors of the houses, the drinking vessels, and feeding troughs are at once infected by the diseased birds, and the well ones soon contract the disease from the contaminated water and feed. It is consequently but a few days before a large part of the flock shows symptoms, though some are much more severely affected than others.

Symptoms.—Diphtheria begins as a local irritation or inflammation at some point on the internal surface of the mouth, throat, nostrils, or eyes. At this time the general health is not yet affected,

and there is nothing but the diphtheritic deposit to indicate that the bird has been attacked. This deposit is at first thin, yellowish or whitish in color, and gradually becomes thicker, firmer, and more adherent, so that considerable force is required to remove it. The mucous membrane beneath the deposit is found, when the latter is removed, to be inflamed, ulcerated, and bleeding, but it is soon covered by a new deposit. This deposit is called a false membrane, and when it is situated where the air passes over it in breathing it dries, becomes uneven and fissured, and its color changes to a dark brown.

With pigeons the deposit is more friable and easily removed, and the mucous membrane beneath it is reddened but not ulcerated.

While the false membranes over the parts first affected are becoming thicker, the inflammation extends to the adjoining surfaces, and new diphtheritic centers develop, uniting with one another until the cheeks, the tongue, the palate, the throat, and the inside of the nostrils are covered. Very often the inflammation extends from the nostrils to the eyes and the sacs beneath the eyes, and sometimes it penetrates the air tubes to the lungs or the gullet to the crop.

This extension of the disease leads to the appearance of other symptoms. The inflammation in the nostrils causes sneezing and the escape of a thin, watery secretion from the nasal openings; the thick false membranes fill up the nasal passages and the throat and obstruct the breathing; a thick, viscid secretion collects on the eyelids and glues them together; the sacs under the eyes fill up and swellings are caused which disfigure the head; the poison which is produced by the growth of the microbe beneath the false membranes is absorbed and affects the nervous system, causing dullness, depression, and sleepiness. The affected bird stands with the neck extended and the beak open to facilitate the entrance of air into the lungs, and from the corners of the mouth there hang strings of thick, tenacious, grayish mucus. At this time, which may be three to five days from the appearance of the first symptoms, the condition is very serious. Swallowing is difficult or impossible; the breathing is so obstructed that hardly sufficient air can be inhaled to support life; the head is swollen; the eyes are nearly or entirely closed; the feathers of the head, neck, and breast are foul with the decomposing secretions from the nostrils and mouth; there is considerable fever; an exhausting diarrhea sets in; there is rapid loss of weight; the comb and wattles become pale and cold; the temperature of the body finally sinks below the normal, and death soon follows.

When false membranes form in the gullet, crop, and intestines there is a rapid aggravation of the symptoms, an intense diarrhea, and the escape of blood with the droppings. This type of the disease is more frequent in waterfowl than in other birds. Some fowls in a

flock are resistant, and after a few days of illness make a rapid recovery. Others remain dull, weak, and thin in flesh, and may have more or less catarrh and difficulty of breathing for a long time.

The period between exposure to the contagion and the appearance of the first symptoms varies from 3 to 15 days; the duration of the disease varies from 2 to 3 days to as many weeks in the acute cases, while the chronic form may continue for several months. The average death rate is from 50 to 60 per cent of the flock.

Treatment.—The treatment of fowls affected with diphtheria requires much time and patience, and as a rule does not pay. It is better to kill those affected, bury or burn their carcasses, disinfect the poultry houses, and in that way eradicate the contagion as soon as possible, even if the whole flock must be sacrificed.

If it is decided to treat the sick birds, they should be removed from the flock and put into a comfortable, well-ventilated room that may be easily disinfected. Make a solution by dissolving 2 drams of common salt in a quart of warm water, and with a soft brush or a pledget of absorbent cotton dipped in this solution gently brush or rub the false membranes until they are disintegrated and loosened from the underlying tissues. Sometimes it is necessary to scrape them off with a spoon or knife, but it must be done carefully so that bleeding will not be caused or the sensitive tissues injured. After the false membrane has been removed, moisten a pledget of absorbent cotton in a 2 per cent solution of lysol or carbolic acid and apply it for a minute or two to the diseased surface. A solution which gives good results is made by dissolving 35 grains of chlorate of potash and 2 grains of salicylic acid in 1 ounce of water and adding 1 ounce of glycerin. This may be applied to the diphtheritic spots three or four times a day with a pledget of absorbent cotton.

Another solution which is often recommended is made by dissolving 16 grains of permanganate of potash in half a pint of water. A very good and also harmless solution consists of 1½ ounces of boric acid and 1 ounce of powdered borax (biborate of soda) dissolved in 1 quart of water and applied warm. The two last-mentioned solutions may be used to wash the eyes or may be injected into the nostrils. Argyrol may also be used as recommended in contagious catarrh.

If large swellings appear beneath the eyes they should be opened with a clean, sharp knife, the contents of the cavity removed, and the space frequently washed with the boric-acid-borax solution mentioned above.

The cages and the room in which the sick birds are kept should be disinfected daily with a 5 per cent solution of carbolic acid or a 2 per cent solution of cresol.

BIRD POX (CHICKEN POX).

Bird pox is a condition characterized by an eruption of nodules varying from the size of a millet seed to that of a pea, which occurs on the comb, wattles, ear lobes, and less frequently on the skin of other parts of the body. It is more frequent and more malignant in warm than in cold climates, but occurs in most parts of the world. Recent investigations make it probable that it is caused by a filter-

FIG. 3.—Chicken-pox nodules on comb, on wattles, and near corner of mouth. (After Hutÿra and Marek.)

able virus which is identical with that of diphtheria. As the symptoms of the two conditions are generally quite distinct, they are here described separately. (Fig. 3.)

Causation.—Bird pox, so far as known, does not originate in any other way than by contagion. It seems to be produced by virus from fowls or pigeons affected with either the eruption of bird pox or the false membranes of diphtheria. Experiments have shown that both pox and diphtheria are easily transmitted from fowl to fowl and from pigeon to fowl, but the transmission of pox from fowl to pigeon has proved very difficult and that of diphtheria impossible. The con-

tagion is believed to exist in the blood as well as in the nodules which appear upon the skin.

The disease is generally introduced by new birds which are put into the flock or by exhibition birds which return infected. Probably it is often brought by pigeons, sparrows, and other birds which fly from one yard to another. The inoculation of the comb and wattles appears to occur by rubbing these parts with the infected feet or by being injured by the infected beaks of other birds.

The virus is quite resistant and requires thorough disinfection for its eradication.

Symptoms.—The eruption appears as round, oblong, or irregularly shaped nodules from the size of a pinhead to that of a pea or a hazelnut. They are seen especially about the beak and nostrils and on the comb, the eyelids, the wattles, and the ear lobes. In some individuals, and particularly in pigeons, the eruption is more generalized and is found on the skin of other parts of the body, as the neck, under the wings, on the rump, and about the vent. Here the nodules may become larger than on the head.

The nodules begin as small red or reddish-gray deposits with a shiny surface, and gradually enlarge, while the color changes to a yellowish, brownish, or dark brown, and the surface dries and becomes shriveled, uneven, and warty in appearance. Owing to the number of nodules and the extension of the inflammation, large patches of skin become thickened and covered with hard, dry crusts, closing the nasal openings or the eyelids and making it difficult even to open the beak.

In the milder cases the eruption is limited to the head, the nodules are distinct and small, and the general health of the affected bird does not suffer. The nodules soon dry, heal, and shrink; the crusts become loosened and fall off, and there is rapid recovery. In the more malignant cases the eruption is generalized over the surface of the body, the nodules are larger, and there is a diffuse inflammation and thickening of large areas of skin. If the crusts are rubbed or scratched off by the fowls, there occurs from the ulcerous surface a discharge at first watery, but later thick, yellowish, and viscid, which soils the feathers and, if abundant, gives off a disagreeable odor. This type of the disease is accompanied with fever, rapid loss of flesh, and prostration, and frequently causes the death of the victim. In the most malignant cases, especially with pigeons, the eruption extends to the mucous membranes of the eyes, nostrils, and mouth, causing a diphtheritic inflammation that is generally fatal.

Treatment.—The mild cases of this disease may be successfully treated by simple local applications. The crusts on the nodules are softened with carbolated ointment, glycerin, or oil, and after an hour or two removed by washing with warm water containing a little

soap. The denuded tissue is then treated with a 5 per cent solution of carbolic acid, or with a saturated solution of boric acid, or with tincture of iodin. If there is much inflammation of the eyes, apply frequently with a medicine dropper or a pledget of absorbent cotton a solution made by dissolving 1½ ounces boric acid and 1 ounce biborate of soda in a quart of warm water. This solution may also be applied to the inflamed skin either before or after the crusts are removed.

As this disease is contagious, the houses, drinking vessels, and feed troughs should be kept disinfected during the outbreak and for some days after all the birds have apparently recovered.

FOWL CHOLERA.

Fowl cholera is an infectious disease of a septicemic character, marked by rapid spread through a flock and high mortality. It attacks fowls, turkeys, ducks, geese, pigeons, and cage birds.

Causation.—The causative agent is a germ known as *Bacterium avisepticum.* It is carried from flock to flock by sick or recently recovered birds which have been placed in a new flock without being subjected to a period of quarantine, by wild birds, or by persons, animals, or utensils which have been on infected premises.

Symptoms.—The first symptom is a yellowish coloration of that part of the excrement which is secreted by the kidneys and which in health is nearly or perfectly white. Soon there is diarrhea, the droppings consisting of the whitish or yellowish secretions of the kidneys mixed with considerable thin mucus and a small quantity of intestinal contents which may have a yellowish, brownish, or greenish color. There is considerable fever, and soon after the bird is attacked it loses its lively appearance, separates itself from the flock, and appears dull, dejected, and sleepy. It no longer searches for food, but sits with the head drawn down to the body or turned backward and resting in the feathers about the wing. The plumage soon loses its brilliance, the wings droop, the appetite is diminished, and the thirst increased; the comb and wattles may be a dark-bluish red from engorgement with poorly oxygenated blood, or they may be pale and bloodless on account of the congestion of the internal organs, especially the liver.

The affected birds soon become very weak, drowsy, and often sleep so soundly during the last day or two of their lives that it is difficult to arouse them. If made to move they stagger forward for a few steps only in an uncertain manner and with dragging wings. The crop is generally distended with food and apparently paralyzed, and the feathers about the vent are soiled and sometimes pasted together with excrement.

The weight and the strength of the bird rapidly diminish, it breathes with difficulty, sits with the beak open, and the breathing may be heard at some distance. Finally the weakness is such that the beak is rested on the ground, and a little later the bird dies.

In the very acute cases no symptoms are seen; the birds may be found dead under the roosts or they may fall at the feed trough and die in a few minutes.

The disease often occurs in a chronic form, which may follow an acute attack, or it may be chronic from the first. This form is characterized by a continually increasing weakness, loss of weight, bloodlessness, and, finally, an exhaustive diarrhea. Sometimes one or more joints of the wings or feet swell, the bird becomes very lame, and later the swellings break and discharge a creamy or cheesy mass which contains large numbers of the germs.

Cholera may destroy the greater part of a flock in a week and then disappear, or may linger for months, only occasionally killing a bird. The time between exposure to the contagion and the appearance of symptoms is from two to five days, and the duration of the disease is from 24 hours to 10 days.

The most characteristic changes seen after death are red spots on the surface of the heart which give it the appearance of having been sprinkled with blood, congestion of the intestine, enlargement of the liver, and swelling of the spleen.

Treatment.—Since treatment of affected birds is almost futile, the aim should be to prevent so far as possible the spread of infection. The first fowls showing acute feverish symptoms should be destroyed by a method which would guard against the contamination of the premises by infected blood. The carcasses should be burned or deeply buried. The healthy fowls should be moved to new quarters if possible and carefully watched for signs of disease. Houses and runs should be thoroughly cleaned frequently and disinfected with carbolic acid in 5 per cent solution, compound cresol in 2 per cent solution, or a reliable coal-tar disinfectant in proper dilution. The drinking water may be made antiseptic by adding 1 dram of permanganate of potash to each gallon. This serves to prevent the spread of disease through the water and also is a convenient means of administering an internal antiseptic.

Prevention and treatment with antiserum and vaccines have not proved sufficiently satisfactory to warrant advising the use of such preparations in their present state of development.

CHOLERALIKE DISEASES.

There are several diseases similar to cholera which have been investigated and described as different because the bacteria which

cause them differ in some of their characteristics. The symptoms and the changes which are seen after death are so nearly identical that it is only by studying the bacteria that any one of these diseases can be distinguished from the others. The treatment applicable to one is equally applicable to the others. For the practical purpose of combating them in the poultry yard we may therefore group these diseases together.

Causation.—Certain germs (bacteria) like *Bacillus coli*, which are nearly always found in the intestines of healthy fowls, have more or less power to produce disease, but the sound, healthy fowl is able to resist them under favorable conditions. If these germs are inoculated into canary birds, they produce a fatal disease, because the canary does not have the power to resist them. If inoculated from one canary to another three or four times, these germs have their disease-producing powers so increased that they are able to kill adult fowls. When the resisting powers of fowls are diminished by exposure to cold, hunger, thirst, and exhaustion, as occurs during long shipments by rail, these germs may also cause disease in the fowls. In some countries the sickness which develops from these conditions is called "the transportation disease."

It sometimes happens that these diseases develop in poultry yards which are not kept clean, possibly because of the large numbers of germs which are taken into the bodies of the birds. When they begin growing in the tissues of fowls they soon increase their virulence, and the disease which they cause may rapidly spread from fowl to fowl until the greater part of the birds are dead.

The choleralike diseases may, therefore, either develop in the poultry yard from insanitary conditions, or they may be introduced by contagion carried by new birds which are added to the flock, by birds which have been to exhibitions, by wild birds which fly from one poultry yard to another, or by various animals, such as dogs, cats, rats, etc. Birds which recover from a disease may sometimes carry the germs and disseminate the contagion for six months or a year after they are apparently well.

Symptoms.—The manifestations of these diseases are much like those of cholera and for practical purposes need not be given separately. The choleralike diseases are differentiated from true cholera by their slower spread and lessened mortality.

Treatment.—Treatment and prevention follow the same lines advised for cholera.

FOWL TYPHOID.

Fowl typhoid is a septicemia of fowls characterized by a drowsy, anemic appearance, extensive blood changes, and alterations in the

abdominal organs. It may at times occur in extensive epizootics. It bears no relation to typhoid of man.

Causation.—The causative agent, *Bacterium sanguinarium*, is a small rod-shaped organism which closely resembles *Bacterium pullorum*, the organism of bacillary white diarrhea of chicks. It is introduced on the premises through the agency of carriers, such as infected fowls, materials from infected poultry plants, by free flying birds, or on the feet of men or animals which have been on infected premises. The disease usually spreads rapidly in a flock, but is not so destructive as acute fowl cholera.

Symptoms.—There is drowsiness followed by prostration, which may last for several hours to one or two days. The membranes of the head, comb, and wattles are paler than normal; the temperature is elevated 3° or 4°. The blood is thin, pale red in color, and does not clot readily. The red blood corpuscles are greatly decreased in number, while the number of white blood corpuscles is greatly increased. Internally the liver is much enlarged, dark colored, and covered with minute necrotic spots. The spleen may also be enlarged and softened. The serous membranes are pale. Occasionally the mucous membrane of the intestine is slightly congested. In the fatal cases death occurs in 3 to 15 days after exposure.

Treatment.—The treatment advised for cholera applies also to fowl typhoid.

WHITE DIARRHEA OF CHICKS.

White diarrhea is a condition which has as its most prominent symptom more or less profuse diarrhea, the droppings consisting almost entirely of mucus from the intestinal tube and the white secretion of the kidneys. The diarrhea results from irritation of the intestines and the increased secretion of mucus, while the large quantity of white material secreted by the kidneys is due to fever and the rapid breaking down of the elements of the tissues. This condition is most frequently seen with incubator chicks, but is also common with those which are hatched under hens. (Fig. 4.)

Causation.—It has been found by investigation that the white diarrhea of young chicks is caused by at least four different kinds of infection, and each of them needs to be studied separately. All these microbes also infect adult fowls and are generally communicated directly or indirectly from these to the chicks

The most common cause of the disease is an organism called *Bacterium pullorum*. This often infects hens and also the eggs which they lay. Such eggs produce chicks which have the germs of the disease within them when they are hatched, and these chicks show symptoms within the first few days of their lives. The contagion may also be communicated from chick to chick by means of the

microbes scattered with the droppings, which contaminate the food and drink and cause the appearance of the symptoms when the birds are from one to two weeks old. The chicks are most susceptible to infection during the first 24 hours of their lives, are more resistant during the second and third days, and are practically insusceptible after the fourth day. Those that sicken later must have taken the microbes into their bodies before they reached that age. Incubators and brooders, as well as coops, become infected and preserve the contagion indefinitely. Adult fowls are quite resistant to this microbe and usually do not show any symptoms, even when they are laying infected eggs.

The cholera bacillus may also be carried by laying hens and infect the egg before it is laid. The young chicks hatched from such eggs

FIG. 4.—Chicks affected with white diarrhea.

soon show symptoms of disease and communicate the contagion to others at all ages.

The coccidia which cause a chronic disease in adult fowls may also infect the eggs and cause disease with similar symptoms in the chicks.

The aspergillus fungus is the fourth cause of white diarrhea. It occasionally is included in the egg when it is laid, but it may also penetrate the shell when eggs are packed in moldy chaff, straw, or grain, or allowed to get damp.

All these germs may also be carried on the outside of the shell and may infect nest boxes, incubators, brooders, and yards where diseased chickens have been.

Symptoms.—The symptoms of white diarrhea are seen in young chicks which are from a day or two to three or four weeks old. In the most acute form they may die suddenly after having shown but slight symptoms for a short time. Generally, however, there is first observed a disposition to huddle together and to remain under the hover or under the hen more than young chicks should. Very soon

they appear listless, stupid, sleepy, and indifferent to what is going on about them. They stand in one position or sit still with the eyes closed, and the few efforts which they make to pick up food appear mechanical and unsuccessful. Their plumage loses its luster, the wings droop or project slightly from the body, and the characteristic diarrhea soon appears. The droppings which are voided may be white and creamy, mucilaginous and glairy, or they may be mixed with a brownish material. In acute coccidial white diarrhea the droppings are frequently bloody. Often the sticky excrement adheres to the downy feathers about the vent, dries, and continues to accumulate until it completely covers and plugs the opening. This condition, known as "pasting up behind," will, unless soon relieved, bring about the early death of the chick.

Many of the diseased chicks chirp or peep almost constantly, and when attempting to void the excrement they may give utterance to a shrill cry, as if the effort brought on paroxysms of pain. As death approaches, the breathing becomes labored and the abdomen heaves with each breath.

Often the disease is of a more chronic type and has a longer course. The young birds with diarrhea gradually waste away, becoming weaker and more emaciated until their legs are scarcely able to support their bodies. They try to brace themselves by standing with the legs apart, or they rest against a wall or other object for support. Many of them have the peculiar form of body called "short backed," which results from the distention of the abdomen and its projection backward, which makes the back appear too short for the body. Toward the last the strength is completely exhausted, and the chick sits constantly or lies on the side with outstretched wings until it dies. The most prominent and characteristic symptoms in nearly all cases are the white diarrheal discharges and the rapid wasting away of the affected birds. The losses vary from 50 to 80 per cent of the chicks hatched. Sometimes it is impossible to raise any of them.

Post-mortem examination reveals an unabsorbed yolk in the majority of cases. In white diarrhea caused by *Bacterium pullorum* the liver may have an ocher color and areas of congestion. The lungs may show small necrotic spots. In coccidial white diarrhea the cæca or blind pouches of the intestine are usually distended with necrotic or bloody material. In aspergillar white diarrhea the lungs and air sacs are the seat of moldy growths.

Treatment.—The medical treatment of affected chicks is impracticable, except in the coccidial form, as it is too expensive and has very little effect on the course of the disease. The birds may be given sour milk or buttermilk to drink. One-third teaspoonful of powdered catechu added to the gallon of drinking water is very effective in the coccidial form of white diarrhea.

Prevention.—The preventive measures should begin with the eggs used for hatching. If these are purchased, they should be accepted only from flocks known to be healthy and the eggs of which give rise to healthy chicks. If this assurance can not be obtained, it is better to produce the eggs needed for hatching on the home farm and from hens that are known to be free from infection.

Having obtained the eggs, they should be kept until ready for incubation in a dry, moderately cool place, so spread out that the air can circulate over them and carry away the moisture which they exhale. They should not be placed in hay, straw, chaff, or other substance liable to become musty or moldy. Before putting them into the incubator or under the hen they should be wiped with a cloth wet in grain alcohol of 70 to 80 per cent strength to remove any germs that might be on the surface of the shell. The hens used for hatching should be free from all infection, and the incubator should be thoroughly cleaned. If there have been any sick chicks in it, it should be disinfected by washing with compound solution of cresol (5 per cent solution). The same precautions should be adopted in regard to the brooder.

If the hatching is done by a hen the brood should be put upon fresh ground, and any chicks which sicken should be immediately removed and isolated or killed. By removing frequently to fresh ground or by frequent disinfection the disease may sometimes be limited to a few individuals.

If the hatching is done in an incubator and there is reason to suspect that the disease may develop, it is well to divide the trays and the brooders by light partitions so that not more than four or six chicks will be in one lot and exposed to one another. If white diarrhea appears in any of these lots, such lots may be removed and the places which they have occupied may be disinfected. After four or five days the partitions may be removed and the healthy lots of chicks put together. In this way the greater part of the chicks are protected against the most common form of the disease.

BACTERIUM PULLORUM INFECTION OF FOWLS.

The *Bacterium pullorum* also causes a form of disease which is generally confined to the ovary. Except in the case of comparatively rare acute outbreaks, no external symptoms are apparent. This infection is widespread in the United States and is responsible for enormous losses through its spread by means of the egg to baby chicks, causing white diarrhea.

Causation.—Chicks which recover from bacillary white diarrhea frequently retain the causative organism, *Bacterium pullorum*, in their systems, where it later localizes in the active ovary. The disease

may be contracted also by feeding with fowls that harbor the organism or by eating infected eggs. In some cases 50 to 70 per cent of a flock of hens may be found affected.

Symptoms.—In acute outbreaks or in experimental infection the bird becomes droopy, the feathers ruffled, the comb and wattles pale, and the head drawn back. There is loss of appetite, and diarrhea is often in evidence. Death follows in from one to several days.

In the ordinary form of the disease no external symptoms are observed. Internally the ovary presents a characteristic appearance. The partially or wholly developed ova (eggs) are angular in outline, shrunken, hard, and discolored to a dark-brown or greenish color.

FIG. 5.—Normal ovary of fowl (left) and ovary affected with *Bacterium pullorum* (right). (After Rettger.)

(See fig. 5.) At times ova containing dark fluid are present. The bacterium is readily recovered from the ovary by means of artificial culture media.

The presence of the disease in a flock may be detected by post-mortem examination and by laboratory methods.

Treatment.—The nature of the affection renders treatment futile. Flocks which harbor the infection should not be used for breeding purposes. The cycle of infection established by the hen, the egg, the recovered baby chick, and pullet indicates that it is not advisable to save for breeders any chicks which have been exposed to an outbreak of white diarrhea.

COCCIDIOSIS.

Coccidiosis is a disease produced by parasitic organisms of microscopic size called "coccidia." These parasites are widely distributed in nature and frequently attack birds and the smaller mammals, such as rabbits, rats, and mice. They are very destructive to young birds.

Causation.—Many different species of birds are attacked by coccidiosis. Pigeons are particularly liable to the disease, and are frequently responsible for outbreaks in poultry yards. The transmission of the contagion from diseased to healthy birds occurs by contamination of the food, water, gravel, and other substances taken into the digestive organs. The coccidia multiply with great rapidity in the intestines of diseased birds, and enormous numbers are discharged with the droppings and are carried on the birds' feet to the feed troughs and drinking fountains unless these are well protected and of such form that they can not be reached by the feet. Under any circumstances they are spread over the floor of the houses and the surface of the runs, and many will be picked up with gravel, grain, and other substances. The germs are found in the part of the small intestines nearest to the gizzard, where they cause inflammation with redness and thickening of the intestinal wall. They are also found in the cæca (two blind pouches of the intestine), which are frequently thickened and distended with a whitish, yellowish, or greenish-yellow, pasty mass. After two or three weeks the disease may extend to the liver and lungs, where it is recognized by whitish or yellowish spots or by large, cheesy nodules. Geese are attacked by another species which causes nodules in the kidneys.

Symptoms.—Adult fowls have considerable powers of resistance to this parasite, and the disease with them is more frequently seen in a chronic form. The symptoms are dullness, weakness, sleepiness, diarrhea, and loss of weight, although the birds retain their appetites for a considerable time. In many cases the only symptoms are diarrhea, with loss of weight, and after a time apparent recovery, though the germs continue to multiply in the intestine and to be spread with the droppings for several months afterwards. Fowls affected in this manner may die suddenly without previously showing any serious symptoms. Young chicks frequently void bloody droppings, and the bowel contents are bloody.

Pigeons are affected with a more acute type of this disease in which the symptoms appear only a short time before death. Generally, however, they are dull and sleepy for a day or two, and sometimes they have a chronic form, characterized by diarrhea and loss of weight.

Geese with coccidiosis of the kidneys lose flesh rapidly, without apparent cause, and become very weak and almost unable to walk.

They remain quiet most of the time, with the belly resting upon the ground. Some of them lie on their backs with their feet widely separated, and if placed upon their feet take a few steps, fall, and resume the former position. In all such cases the birds lose their appetites and become progressively weaker until they die.

Treatment.—The most successful treatment has been to put one-third teaspoonful of catechu in each gallon of the water given the birds to drink. Permanganate of potash, one-fourth of an ounce to the gallon of drinking water, is quite effective. They should also be given an occasional dose of calomel (¾ to 1 grain) or castor oil (2 to 3 teaspoonfuls), mixed with 10 drops of oil of turpentine for each adult.

Prevention.—As the coccidia are brought on the premises with birds or with eggs for hatching obtained from infected flocks, or by pigeons flying from place to place, the necessary precautions should be observed to guard against such channels of infection. Fowls and eggs should be obtained only from flocks known to be healthy, and pigeons should be excluded from the poultry yard.

This form of contagion is very difficult to destroy, and the most active disinfectants should be used. A mixture containing 10 per cent of the compound solution of cresol is not too strong. The bodies of the birds which die should be burned.

ASPERGILLOSIS (BROODER PNEUMONIA).

One of the common molds, called *Aspergillus fumigatus*, sometimes attacks the respiratory or digestive organs of fowls, especially young chicks, producing either whitish or yellowish tuberclelike nodules in the tissues or large, flat elevations of a dirty yellow or greenish coloration on the surface of the mucous membranes. Each of the nodules contains a growth of the mold at its center, inclosed and imprisoned by a wall of animal cells. The flat elevations, however, represent the free growth of the mold on the surface of the mucous membrane, having very much the appearance which it presents when growing outside of the body on dead organic matter. The greenish color of the diseased area is due to the greenish filaments of the mold or fungus growing upon its surface. The filaments are not all on the surface, however, but penetrate deeply into the tissues, causing inflammation and swelling, which obstruct the respiration, and at the same time they apparently produce a poison which causes general depression and fever. The changes caused by the development of this fungus are most frequently seen in the mouth, the trachea, the bronchial tubes, the lungs, and the air sacs, but they may occur also in the alimentary canal.

Causation.—The *Aspergillus fumigatus* is a very common fungus of great vegetative and resisting powers which is found everywhere

growing upon dead organic matter of the most varied kinds. Its development is favored by warmth and moisture, and its spores are often found in enormous numbers in musty or moldy hay, straw, or grain. The mucus on the surface of the membranes, the serum beneath them, and the temperature of the bird's body are all favorable to its growth, while in addition it has the power to resist the efforts of the animal tissues to overcome and dislodge it. Having such characteristics, this fungus is one to be excluded, so far as possible, from the habitations of poultry, for otherwise it may cause severe and fatal disease.

The spores of aspergillus are most frequently introduced with moldy hay, straw, or chaff that are given to the fowls to scratch in. Often the fungus grows on accumulations of manure, old leather, and similar substances when they are sufficiently moist, and produces spores in enormous numbers. The filaments of the fungus are capable of passing through the eggshell, and it is believed that some outbreaks in brooder chicks may be due to infected eggs which have been exposed to moldy material. Not all birds are susceptible to its attacks, and it seems to be the delicate breeds and the weak individuals that are most frequently its victims.

Symptoms.—This disease may be limited to a single bird, or it may affect a large number. When the air tubes or lungs are attacked, the first symptoms are a slight catarrh with accelerated breathing. Soon the swellings obstruct the passage of air, and there is a rattling or croupy sound, heard chiefly during expiration. The affected birds mope, separate themselves from the remainder of the flock, or remain in a sitting posture; if made to move, it is seen that they are weak and scarcely able to walk, and if they try to run they soon fall from exhaustion. The difficulty of breathing increases rapidly; they gasp for breath, and make movements of the head and neck, as if choking; there is fever, diarrhea, drooping wings, great depression, a tendency to sleep, and finally suffocation and death.

When the disease is limited to the large air sacs the only symptoms are progressive loss of flesh and weakness. If the small air sacs of the bones are involved, which rarely occurs, there may be lameness, with swollen and inflamed joints. After death the yellowish nodules are sometimes found in the liver and kidneys as well as in the other organs which have been mentioned. The symptoms in brooder chicks are similar to those of white diarrhea.

Treatment.—This disease is a most difficult one to cure, but sometimes affected birds may be saved by applying flowers of sulphur or tincture of iodin to the diseased patches seen in the mouth and throat, and causing the birds to inhale the vapor of tar water or turpentine. Tar water is obtained by stirring two tablespoonfuls of wood tar in a quart of warm water and letting the mixture stand

for a few hours. Then the birds are taken into a closed room, where the tar water is poured, a small quantity at a time, on a hot brick or stone until the atmosphere of the room is well charged with the vapor.

Prevention.—The disease is prevented by giving only clean and bright straw or chaff for the fowls to scratch in, by keeping the houses and yards clean, and using grain and meal for feed which are sound and entirely free from mold. The sick birds should be removed from the flock, and the bodies of those which die should be burned or buried. The fungus sometimes spreads from bird to bird; consequently the isolation of the sick and the disinfection of the houses should not be neglected. Incubators and brooders should be cleaned and disinfected before use.

TUBERCULOSIS.

Tuberculosis of fowls is a chronic contagious disease, characterized by the development of nodules called tubercles in various organs of the body, but most frequently in the liver, spleen, and intestines. The disease is caused by a bacillus which differs somewhat in its manner of growth in artificial cultures from the bacilli which cause tuberculosis of people and of cattle. The tuberculosis of fowls is readily communicated to most species of birds and to several species of mammals, but it is almost impossible to communicate the tuberculosis of man and of cattle to fowls. Parrots and the smaller cage birds are very susceptible to human tuberculosis, however, and are often affected by it.

Causation.—Tuberculosis is generally brought into the poultry yard with fowls that are purchased from infected flocks or with the eggs of diseased birds that are obtained for hatching. If the disease exists in neighboring flocks the contagion may be carried by small birds or animals passing from one yard to another. A peculiarity of tuberculosis of birds is that the liver and intestines are nearly always very severely affected, and that as a consequence the bacilli are very numerous in the intestinal contents and are scattered with the droppings everywhere that the fowls go. The introduction of a single diseased bird may, therefore, cause the infection of the greater part of the flock in a few weeks. In the same way, when wild birds contract the disease the bacilli are carried and deposited in all the yards which they visit. (Fig. 6.)

The eggs of diseased birds frequently contain the bacilli, as has been proved by the inoculation of material from such eggs into susceptible experimental animals. The young chicks hatched from such infected eggs are diseased when they leave the shell and, of course, soon infect the poultry with which they run. Moreover, since the sterile incubated eggs are often fed to chickens, it is clear that even

the eggs which do not hatch may introduce the contagion unless they are cooked before feeding.

Pigs, cats, rats, and mice are especially liable to be infected with fowl tuberculosis from eating the carcasses of birds which have died, and these animals serve to keep up the contagion and may communicate it to other fowls. Even calves and colts are sometimes found suffering from this form of tuberculosis.

Symptoms.—Symptoms are generally not observed in the internal tuberculosis of fowls until the disease has reached an advanced stage of development. They begin with gradual loss of weight, wasting of the muscles, paleness of the comb, and, toward the end, dullness, sleepiness, and diarrhea. Very often there is at the same time a

FIG. 6.—Liver of pheasant, showing lesions of tuberculosis.

tuberculous inflammation of the joints and of the sheaths of tendons which is revealed by lameness, swelling of the joints and legs, and sometimes by the formation of hard external tumors of considerable size. Occasionally the skin over the swollen joints breaks, the interior of the joint is ulcerated, and a small quantity of pus containing large numbers of tubercle bacilli is discharged. Swellings and bony enlargements of the joints with fowls are invariably suspicious, and their nature should always be investigated by killing the bird and examining the liver, spleen, and intestines to determine whether these have any whitish or yellowish spots on their surface which, when cut into, prove to be tuberculous masses.

Tratment.—There is no treatment that will cure fowls which have been attacked with tuberculosis. When the disease is discovered the

effort should be to eradicate it at once by killing off the whole flock and thoroughly disinfecting all the houses and runs.

As the great majority of the birds will probably be more or less affected, the chances are that any which are saved will have diseased livers and intestines, from which the bacilli will escape and keep up the infection of the flock and the runs. The danger of this is so great that no attempt should be made to keep any of the fowls that have been exposed to the contagion, no matter how valuable they may be. The bodies of the birds that have died or are killed, as well as all the accumulated manure, sweepings, and scrapings of the poultry houses, should be completely destroyed by fire.

So far as known there is no danger of communicating the disease to man by eating the cooked flesh of tuberculous fowls. In most cases, however, the diseased birds are so emaciated and their general health so affected that their flesh is not fit for human consumption. It is better in all cases to burn the carcasses of the birds in which tuberculous nodules are found, and thus avoid all danger of the disease being communicated to either man or animals.

BLACKHEAD (ENTEROHEPATITIS).

Enterohepatitis or blackhead is a disease of the intestine and liver which is most frequent in and most injurious to turkeys, but which according to some writers also attacks common fowls. In the course of the disease the head often becomes dark colored or nearly black, and for that reason it is popularly known as "blackhead," although it is only the internal organs that are directly affected by the disease. Blackhead is widely disseminated and in some localities has made the production of turkeys nearly impossible.

Causation.—The cause of blackhead is not definitely known. Three theories have been advanced in explanation of it: First, that it is caused by a parasitic protozoan known as *Amœba meleagridis*. According to this theory the amœba leaves the body of the sick bird with the excrement and infects other birds by entering the digestive organs with the food and drink. Second, that the microscopic elements which are always found in the diseased livers and cæca[1] of turkeys infected with blackhead are not amœbæ, but forms of certain other protozoan organisms known as flagellates. These flagellates occur in practically all turkeys, in the intestinal tract. Under ordinary conditions they are present in small numbers and cause no apparent trouble. In the presence, however, of unfavorable circumstances such as are liable to arise when turkeys are kept under the artificial conditions of domestication, digestive disturbances associated with diarrhea may occur, and in this case the flagellates multi-

[1] The cæca are two blind pouches or lateral extensions in the intestine.

ply rapidly and become very numerous. Many of them penetrate into the lining of the cæca and into the underlying tissues, and from there they may also be carried by the blood stream to the liver, where they establish new centers of disease. The third theory is much the same as the second but lays no stress upon the association of the disease with parasitic organisms. According to this theory the cause of blackhead is closely associated with the fact that the turkey is a species which has not become well adapted to the artificial conditions of domestication and that losses can best be avoided by handling turkeys with due regard to this fact. It is particularly important

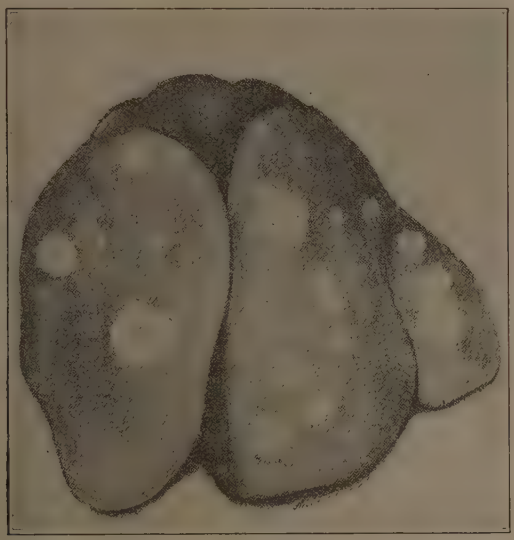

FIG. 7.—Enterohepatitis (blackhead). Liver of turkey, showing necrotic areas.

that care be taken in selecting strong, healthy stock, feeding properly, and protecting the young birds from infestation with lice and mites. The regular feeding of sour milk or buttermilk is believed by some writers to help in preventing the occurrence of blackhead.

Symptoms.—The symptoms of blackhead are most frequently seen in young turkeys, commonly called "poults," which are from 2 weeks to 3 or 4 months old. In the more acute cases the turkeys usually die in about two or three weeks, but generally the progress of the disease is slower and they live a longer time.

The affected birds at first appear less lively than usual, are not so active in searching for food, and when fed show a diminished appetite. Diarrhea is a nearly constant symptom, naturally associated with the inflammation of the cæca. As the disease progresses

there is more dullness and weakness, the wings and tail droop, and there is often the peculiar discoloration of the head, which led to the disease being called "blackhead." There is increasing prostration and loss of weight; the affected birds, instead of following their companions, stand about in a listless manner, indisposed to move and paying little attention to what occurs about them.

The greater part of the affected poults die within 3 or 4 months after hatching, but with some the disease takes a more chronic form and does not cause death for a year or more. Nearly all die sooner or later from the effects of the disease, but in a small proportion of the cases there is healing and recovery.

The finding after death in young turkeys of the diseased and thickened cæca plugged with cheesy contents, together with the yellowish or yellowish-green spots in the more or less enlarged liver, is sufficient indication to warrant a diagnosis of blackhead.

Treatment.—The treatment of diseased birds has not given satisfactory results. The remedies most often used are: Sulphur 5 grains, sulphate of iron 1 grain; or benzonaphthol 1 grain, salicylate of bismuth 1 grain; or sulphate of iron 1 grain, salicylate of soda 1 grain. These remedies should be preceded and followed by a dose of Epsom salt (10 to 35 grains), or of castor oil (½ to 3 teaspoonfuls). One-third teaspoonful of catechu to the gallon of drinking water may also have a beneficial effect. It seems clear, however, that it does not pay to doctor the sick poults and that the only hope of success at present is in preventing their infection.

Prevention.—As already stated, the cause of blackhead is uncertain, and a good deal of uncertainty likewise surrounds the question of preventive measures. The measures which have been suggested by various investigators in most cases have been evolved upon the basis of the theory that the disease is caused by an amœba. Some of these measures are as follows: (1) Obtaining eggs from birds believed to be healthy; (2) wiping the eggs with a cloth wet with alcohol (80 to 90 per cent) before they are placed in the incubator or under the hen for hatching, to remove any contagion that might be on the shell; (3) hatching in an incubator, or at least removing the eggs from under the hen a day or two before hatching would occur, wiping with alcohol, and finishing in an incubator, in order to avoid exposing the poults to the hen; (4) placing the young poults on ground at a distance from all other domesticated fowls and not recently occupied by other fowls; (5) excluding, so far as possible, pigeons, other wild birds, and rats and mice from the houses and runs occupied by the turkeys; (6) frequent disinfection of the houses, feeding troughs, drinking fountains, etc.; (7) immediate killing of diseased birds and the destruction of their bodies by fire.

As measures for the disinfection of poultry yards into which blackhead has been introduced some investigators have proposed to dig up and burn the surface soil to a depth of several inches, which may be done with small yards but is not practicable with large ones. In most cases the poultryman must be contented with the application of a layer of freshly burned lime that has been carefully slaked to a fine, dry powder. After a few weeks this ground should be plowed and another layer of lime applied. The manure which has accumulated should be burned or mixed with lime and plowed into the ground of some distant field. The walls and floors of the buildings should be covered with a good limewash containing 6 ounces of carbolic acid to the gallon. The fences should receive a coat of limewash. The feeding troughs and drinking vessels should be put into a kettle of boiling water for half an hour. Troughs too large for this should be burned and replaced by new ones.

After these measures are adopted, assuming that blackhead is a contagious disease, the longer the premises are left vacant the more liable is the contagion to be completely destroyed, and the freezing and thawing of winter and spring will probably prove to be of great assistance. In beginning with a new flock the precautions already mentioned may be adopted to prevent a fresh introduction of the disease on the premises.

GOUT.

Gout is marked by the presence of an abnormal quantity of uric acid in the blood, which results in the deposits of urates on the internal organs (visceral gout), or more frequently in the joints (articular gout).

Causation.—The increased quantity of uric acid may be induced by several causes. Prolonged feeding on substances rich in albumin, especially if associated with lack of exercise, is probably the most frequent predisposing factor. Diseases which affect the urinary organs, causing a failure to eliminate the uric acid properly, play an important part in the causation of gout.

Symptoms.—The joints of the feet are most frequently and severely affected, although the wing joints may also be involved. At first the joints are swollen and painful. Later the lesions form into nodular, tumorlike growths which vary in size and may be either hard or fluctuating. Frequently the swellings burst, discharging a yellowish, turbid material containing urates. The bird avoids walking as much as possible and remains in a sitting position. The general health becomes affected, and emaciation gradually occurs, with weakness and frequently diarrhea.

Visceral gout is apparent on autopsy only. The internal organs and serous membranes are found covered with chalklike deposits. The course of the disease is slow.

Treatment.—Artificial Carlsbad salts have proved beneficial. This is prepared by mixing together sodium sulphate 22 grams, potassium sulphate 1 gram, sodium chlorid 9 grams, and sodium bicarbonate 18 grams. Six grams (or one-fifth of an ounce) of this mixture are added to 1 liter (or 1 quart) of drinking water. Tincture of colchicum in 2 to 5 drop doses per bird may also be used. Enlarged

FIG. 8.—Chicken affected with articular gout. (After Xionka.)

joints may be opened and the contents washed out. When moderately severe symptoms are shown it will be best to fatten and kill the bird before the onset of emaciation.

When several fowls in the flock develop symptoms, the diet should be looked into and corrected if necessary. Often a reduction in the quantity of meat scrap and an increase in the green feed will prevent further cases. The entire flock should receive a dose of Epsom salt, one-third teaspoonful to each adult bird.

GAPES.

Gapes is a disease of chickens which develops during the first few weeks of their lives and is made evident by frequent gaping. It is caused by a parasitic worm (*Syngamus trachealis*) which attaches itself to the internal surface of the windpipe, sucks blood from the mucous membrane, and obstructs the passage to such an extent as to interfere seriously with the breathing. The insufficient supply of

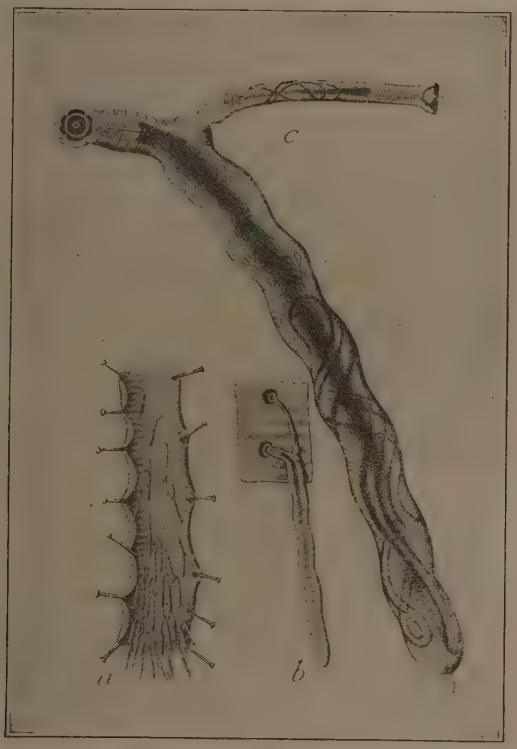

FIG. 9.—The gapeworm of fowls. (*a*) Windpipe of chick slit open, showing worms attached; (*b*) worms slightly magnified; (*c*) worms greatly magnified. (After Mégnin.)

air, the loss of blood, and the diminished activity in looking for food lead to a weak and bloodless condition and often to death from overcrowding or exposure that a well chick would be able to resist without injury. Sometimes so many worms accumulate in the windpipe that breathing becomes impossible, and the chick dies from suffocation. (Fig. 9.)

Causation.—The worm which causes this disease is sometimes called the red worm or the forked worm because of its color and of

the fact that the male and the female are so firmly grown together that they can not be separated without tearing the tissues. The two worms united in this manner appear at first sight like a single worm with two necks and two heads. The female is a little more than one-half inch in length and the male one-fifth inch. The heads of both are attached to the mucous membrane, irritating it to such a degree that there is an increased secretion of mucus, which collects and increases the difficulty of breathing.

A large number of eggs develop in the female worm while in the windpipe, and these eggs, which are microscopic in size, are either thrown out by the chick while sneezing, or they are swallowed, pass through the stomach and intestines unharmed, and are scattered with the droppings. After a short period of incubation the eggs contain young worms capable of continuing their development if swallowed by young chickens. These young worms after hatching out or while still contained in the egg are swallowed with feed or drinking water. They may live a long time in the soil and are sometimes taken into the digestive tubes of earthworms. In badly infested ground a considerable proportion of the earthworms may, if eaten, be capable of causing the disease in chicks.

These facts explain why ground upon which chickens are raised year after year becomes so badly infested and how the infection is carried over from one year to the next. The worms may be carried by turkeys and various kinds of wild birds, which thus help in spreading the infection. When the young worms, or eggs containing sufficiently developed young worms, are taken into the stomach of the chicks, the parasites find their way in a few days to the windpipe, where they may be seen already attached and grown to a considerable size within a week.

Symptoms.—The symptoms of gapes are most frequently observed in chicks from 10 days to 4 weeks old. The affected birds cough or sneeze with an abrupt, whistling sound and a more or less labored effort. Very soon they begin to gape, extending the neck and opening the beak, thus indicating that they are not getting a sufficient supply of air. During the first few days the appetite is ravenous, but in spite of the quantity of food eaten the birds become weak, anemic, and emaciated. Later there is little appetite, the affected birds are dull, have difficulty in keeping with their companions, and as the disease advances their wings droop and they stand with closed eyes and head drawn back into the body. Frequently the head is thrown forward and the bird gapes or gives the head a convulsive shake in order to loosen the obstruction in the windpipe and permit the entrance of air. In this condition it is liable to die suddenly from suffocation, from exhaustion, or from being trampled by its fellows at night.

The most vigorous and the older birds show only mild symptoms or none at all. They may gape occasionally, but their appetites remain good, and they continue to grow. However, as the soil becomes more and more intensely infested the proportion of the chickens which are able to resist the attacks of these parasites becomes less, until finally it may be almost impossible to raise chickens on the premises.

Treatment.—Reliance must be placed upon prevention rather than cure, because a chicken 2 or 3 weeks old has not sufficient value to warrant the expenditure of much time or medicine in its treatment.

Sometimes it is found advisable to extract the worms or to inject some liquid into the windpipe that will kill them. Extractors are made in various ways. Generally a small quill feather is stripped of all its web except a small tuft at the end, and this is used either dry or moistened with kerosene or oil of turpentine. A fairly good extractor may be made by taking a hair from a horse's tail, bending it in the middle, and twisting the two ends together so as to form a loop; or a similar loop may be made by cutting the hair, laying the two pieces side by side, tying a knot near the end, trimming the short ends close to the knot, and twisting the long ends together. These homemade extractors have been imitated in the poultry-supply trade by doubling and twisting a small flexible wire which carries a few moderately stiff hairs to scrape off the worms.

These extractors are all used in the same manner. The chicken's beak is forced open with the thumb and fingers of the left hand, while the extractor is held in the right hand. When the glottis, which is a small aperture at the root of the tongue, is opened for breathing, the extractor is carefully inserted and pressed downward into the windpipe. The neck should be kept extended in a straight line, so that the extractor will enter freely and not injure the delicate walls of the windpipe. At the first insertion the loop or brush should not pass more than an inch below the glottis; then it should be given two or three turns between the thumb and finger and withdrawn. If any worms adhere to it they should be dropped into a basin of hot water or kept and burned. The extractor may now be inserted a little deeper, and so on until it reaches nearly the full length of the neck. If the slightest resistance is felt to the entrance of the extractor, it should not be pressed upon or inserted any farther. In all cases the extractor must be quickly withdrawn to avoid suffocating or otherwise injuring the chicken. Often 8 or 10 worms may be removed in this manner, and if the treatment has not been so rough as to cause injury the symptoms will be very much improved.

Good results have been reported from medicating drinking water with 15 grains of salicylic acid or 3 drams of salicylate of soda to

the quart of water, and the disease is said to be successfully treated by introducing a small soft-rubber tube into the windpipe, in the same manner as described for an extractor, and injecting from 3 to 10 drops of a 5 per cent solution of salicylate of soda.

The best method of prevention is to put the chicks, when hatched, on fresh ground; to remove, place in a separate coop, and treat any that show symptoms, and to plow and seed down the old infected runs, not permitting chickens to go upon them for 2 or 3 years.

INTESTINAL WORMS.

Most chickens are infested with one or more species of parasitic worms, which usually are not numerous and apparently do no harm. If, however, chickens are kept under conditions favoring the spread and multiplication of the parasites (for example, overcrowding in small pens), the fowls may become heavily infested, and in consequence they may be weak, bloodless, and unproductive. The nature of the disease may often be determined by examining the birds that die, or by killing one that is very thin and weak. The intestines should be opened and their contents mixed with water in a dark-colored pan. The white stringy or threadlike worms can then easily be detected and appropriate treatment applied to the rest of the flock.

Roundworms.—Of the various species of roundworms occurring in the digestive tract only two may be specially mentioned, the large roundworm (*Ascaridia perspicillum*), from 1 to 4½ inches in length when full grown, and the cæcum worm (*Heterakis papillosa*), which is from three-tenths to one-half of an inch in length. The former is found in the small intestine, while the latter is buried in the material filling the two cæca or blind guts lying on each side of the intestine.

The following treatment, recommended by the Agricultural Experiment Station of California and tested by the Bureau of Animal Industry, has proved satisfactory for both species:

For 100 birds, steep one pound of finely chopped tobacco stems for two hours in water enough to cover them. Mix the stems and the liquid with one-half the usual ration of ground feed. The day previous to treatment withhold all feed, giving water only. After the birds have been starved 24 hours, feed the medicated mash, and two hours after it is cleaned up give them one-fourth of the usual ration of ground feed mixed with water in which Epsom salt has been dissolved at the rate of 11 ounces for each 100 birds. The treatment should be repeated 10 days later.

After the flock has been freed from worms the houses and yards should be thoroughly cleaned to reduce the chances of reinfestation. The fowls should be removed to temporary quarters and all manure,

loose dirt, and surface earth to a depth of several inches removed. The removed material should be placed where the birds can not get at it, since the roundworm eggs it contains are very resistant and may retain their vitality for as long as a year, possibly longer.

It is important that the yards and runs be kept at all times as clean and dry as possible. Manure should not be allowed to accumulate, and wet spots and puddles of stagnant water should be drained, or the location of the yards changed to a place which can be kept in a sanitary condition.

Tapeworms.—Fowls are often infested with several species of small tapeworms, which may occur in the intestines in such numbers that they seriously injure the health of the birds. One of these tapeworms, known as the spiny-suckered tapeworm (*Davainea echinobothrida*), is of especial interest to poultry raisers, since it produces small nodules in the intestines closely resembling the nodules caused by tuberculosis. If intestinal nodules are found in birds infested with tapeworms, if the liver is not affected, and if other symptoms of tuberculosis, such as lameness, are not present, the condition may be considered to be caused by tapeworms and not by tuberculosis. The tapeworms are usually found attached at one end to the mucous surface of the intestine, and the nodules are due to the irritation thus produced.

The life cycle of chicken tapeworms is not known in all cases, but from what has thus far been worked out it may be stated that the eggs of the tapeworms pass out of the bodies of infected chickens with the droppings and are eaten by various insects and other small invertebrates, within which they undergo a partial development. If the infected insects are then eaten by chickens, the tapeworms reach their complete development in the intestines. For this reason fowls can not infest one another directly through their droppings, as happens in the case of roundworms. However, as it is neither practicable nor desirable to prevent chickens from eating insects, treatment and preventive measures should be directed toward removing the tapeworms from the birds and properly disposing of the manure to reduce the chances of the infection being spread to possible intermediate hosts.

A number of treatments for tapeworms in fowls have been tested by the Bureau of Animal Industry, none of which proved very successful. A few worms may be eliminated by dosing each bird with a teaspoonful of castor oil to which has been added from 10 to 20 drops of oil of chenopodium (American wormseed oil), according to the weight of the bird. The medicine should be given after a fast and repeated in 10 days. If the medicinal treatment is combined with measures to maintain the surroundings in a clean and sanitary condition, including good drainage and removal of the manure and other

litter as discussed under the section on roundworms, infestation with tapeworms is less likely to cause serious trouble than if these precautions are neglected.

FAVUS (WHITE COMB).

White comb, baldness, or favus of fowls is a contagious disease that begins with the formation of white, grayish spots on the comb, ear lobes, or wattles. These spots are caused by the growth of a fungus called *Lophophyton gallinæ*, and they continue to enlarge, run together, and become more inflamed until all the skin of the head and neck is much thickened, roughened, covered with crusts, and

FIG. 10.—Favus ("white comb"). (After Sabouraud.)

more or less bare of feathers. In extreme cases this inflammation may extend over the skin of other parts of the body, affecting the general health and causing weakness, with, finally, exhaustion and death. (Fig. 10.)

Causation.—This disease is transmitted from fowl to fowl by simple contact and is easily transmitted by inoculation from fowl to fowl. It is most frequently seen affecting common fowls and turkeys, and may be communicated by inoculation to mice and rabbits; but attempts to infect lambs, dogs, rats, guinea pigs, and pigeons have failed. It is also easily inoculated on man, producing large red, scaly patches on the skin, and such patches sometimes develop spontaneously, being no doubt due to contagion from affected fowls.

The filaments of this fungus do not penetrate deeply into the skin, but remain very near the surface, and consequently the general

health does not suffer in the early stages of the disease. It is only when a large area of skin is affected that there are symptoms, such as diminution of appetite, loss of weight, and great weakness, which indicate the absorption of poisonous products. Young birds are believed to be more susceptible than older ones, and some breeds appear to inherit a predisposition to this disease, but no age or breed is entirely exempt from it.

Symptoms.—Favus generally begins on the bare parts of the head as small white or grayish spots, round or irregular in form, which increase in number and size and join together until the whole surface is covered. The affected spots are covered with dry, scaly, dirty-white crusts with an irregular surface, and have an appearance of being formed of concentric deposits. Removing the deposit, the skin beneath is seen to be slightly inflamed and abraded. Often the circular spots enlarge regularly and are covered by layers of scales thicker at the periphery than at the center, which gives them a peculiar cup-shaped appearance. As the disease advances the skin becomes thicker, until in the course of a month it may reach one-third of an inch and considerably change the appearance of the head. The neck and body are gradually invaded, the feathers become brittle and break off, leaving a deep depression in the center of a cup-shaped disk. Occasionally the disease is inoculated into the feathered parts of the skin and begins there instead of on the bare parts of the head, but this is exceptional.

The disease when limited to the comb and wattles may disappear without treatment, but after it has invaded the feathered parts it almost invariably continues to advance, and the birds grow weaker until they die from this or some other disease to which their debilitated condition has made them abnormally susceptible.

Treatment.—When only the bare parts of the head are affected the disease may be cured by applying tincture of iodin to the diseased spots. An ointment of calomel 1 part, vaseline 8 parts; or a mixture of soft soap 20 parts, carbolic acid 1 part, may be applied daily. An ointment of red oxid of mercury 1 part, vaseline 8 parts, is also used, as well as olive oil containing 1 per cent of carbolic or cresylic acid.

It is essential that the affected bird should be separated from the flock, put in a dry, clean place, and given good nourishing food. If the feathered parts of the body are affected, it is better to kill the bird, as the treatment would be long and expensive, and there would be danger of the disease spreading.

The disease should be prevented by excluding all affected birds, by burning the bodies of those that die or are killed, and by disinfecting the houses where diseased birds have been.

LICE AND MITES.[1]

LICE.

There are at least seven different species of lice occurring on domestic chickens, while still other forms occur on turkeys, ducks, and guinea fowls. As different species of lice are usually confined to different parts of the body, they are commonly referred to as head lice, tail lice, wing lice, and body lice, although the distinction is not very exact, since the various species intermingle to some extent.

Lice powders and their application.—Recent experiments by the Bureau of Entomology have shown that a very satisfactory way of eliminating lice from poultry is to treat each fowl separately with sodium fluorid. Commercial sodium fluorid may be purchased at most drug stores at from 30 to 60 cents a pound and may be applied either by the so-called "pinch" method or by means of a duster made by punching small nail holes in the bottom of a can having a tight-fitting cover or by dipping. If the pinch method is used, the bird is held on a table while a pinch of sodium fluorid is applied next to the skin under the feathers, as follows: One pinch under the head, one on the neck, two on the back, one on the breast, one below the vent, one on the tail, one on each thigh, and one on the underside of each wing. The feathers should be ruffled to allow the powder to get next to the skin. If the bird is held in a large, shallow pan, the small quantity of powder which falls off will be saved. If the powder is dusted on by means of a shaker the amount of sodium fluorid used may be reduced by using 4 parts of road dust or flour to 1 part of the chemical. This method requires the services of a second person to hold and turn the fowl.

When large numbers of birds are to be treated the sodium fluorid may be used in the form of a dip, using 1 ounce of commercial sodium fluorid to each gallon of water. The bird should be held by the wings and plunged into a tub full of the solution, leaving the head out, while the feathers are ruffled with the hand to allow the solution to penetrate to the skin. The head is then ducked once or twice and the bird allowed to stand a minute to drain and then released. Dipping is just as effective as the other methods, but should not be used on very weak or young birds or in cold or damp weather.

One pound of sodium fluorid will treat 100 birds. Figuring a person's time at 20 cents an hour and the drug at 40 cents a pound, it has been estimated that it costs about $1.25 to treat 100 fowls by the pinch method.

[1] For further details in regard to lice and mites affecting poultry, see Farmers' Bulletin 801, "Mites and Lice on Poultry," by F. C. Bishopp and H. P. Wood, of the Bureau of Entomology.

Another good lice powder is flowers of sulphur, which should be applied with a duster. Although sulphur is considerably cheaper than sodium fluorid, it is less effective against lice and hence must be applied more liberally, so that a treatment with sulphur is in reality more expensive than with sodium fluorid. Many other powders, most of which contain pyrethrum (insect powder), are commonly used, but they have no advantage over sodium fluorid.

Dust baths containing a mixture of tobacco dust or other insecticides, and ordinary road dust are often recommended to destroy lice. While it is a good plan to let the birds dust themselves when they wish, no method which allows the bird to treat itself for lice can be expected to eradicate them all, since fowls can not get the dusting powder on all parts of the body where lice are, and many lousy birds will not use the dust bath.

It is possible and practicable to keep a flock of poultry absolutely free from lice and mites, and this should be the aim of every one who is endeavoring to establish a successful poultry industry.

MITES.

While there are many kinds of mites affecting poultry, there are three which are of especial importance to poultry raisers, the best known being the common chicken mite or red mite (*Dermanyssus gallinæ* de Geer). In the Northern States this mite is dormant in winter except in chicken houses which are heated, but in the South it breeds and is active the year round, although it is always most abundant in summer. Unlike the other mites affecting poultry, this parasite is found on the birds only when it is feeding. It is nocturnal in habits, feeding at night and hiding during the day in the cracks of the roosts, in the nests, in the corners of the floor, and between boards. For this reason its presence often remains undetected until the chicken houses are badly infested and the poultry raiser seeks an explanation for the drooping condition and listlessness of his fowls.

To eradicate the pest a thorough cleaning of the chicken houses and spraying with a suitable disinfectant having a sufficient body is all that is necessary. All roosts, loose boards, and boxes should be removed and the disinfectant applied in the form of a rather coarse spray, using a suitable pump. Some of the best substances for the purpose are the so-called wood preservers which consist of anthracene oil and zinc chlorid. As a mixture of this kind is a little too heavy to spray well, it may be thinned with an equal part of kerosene. Crude petroleum is almost equally effective and is usually cheaper. It should be thinned by adding 1 part of kerosene to 4 parts of crude oil. Pure kerosene, kerosene emulsion, and carbolic acid are all

effective, but as they all lack sufficient body the spraying must be repeated a second or third time at 10-day intervals. The coal-tar dips, used in a slightly stronger solution than recommended on the labels, will prove effective if the application is repeated, and their germicidal properties are a desirable feature. Whatever preparation is used, the birds should be kept out of the houses until the fluid has thoroughly soaked into the wood.

Depluming scabies.—Fowls and pigeons are sometimes infested by an itch mite which lives at the base of the feathers, causing an intense itching and producing a disease known as mange or depluming scabies. The irritation caused by the mites leads the fowls to pull out their feathers, and they often acquire the habit of feather pulling, attacking the plumage of other birds as well as their own. If the stumps of the feathers are examined soon after the breaking of the quill, they will be found surrounded by scales and crusts, and the adjoining feathers when pulled out will be found similarly affected. In this way the condition can easily be distinguished from molting or the vice of feather pulling which fowls sometimes acquire without apparent cause. The mites causing the disease are introduced into the poultry yard by affected fowls and spread rapidly from fowl to fowl, finally infesting nearly all birds in the flock. The disease usually begins in the spring, is most active in warm weather, and disappears in winter.

The affected spots of the skin from which the feathers have dropped out should be anointed for some distance around them with an ointment made by thoroughly mixing 1 part of flowers of sulphur with 4 parts of vaseline or lard, or 1 part of carbolic acid with 50 parts of vaseline. A convenient liquid preparation is made by mixing Peruvian balsam 1 ounce and alcohol 3 ounces. One of these preparations should be selected and applied at least twice with an interval of a week or 10 days.

Scaly leg; mange of the leg.—Another species of itch mite attacking chickens, turkeys, pheasants, and cage birds is the cause of a condition known as scaly leg. While this mite is usually confined to the legs, it may occasionally attack the comb and wattles. The disease occurs in most cases as a result of contagion from other birds, although the mites may also be transferred from the roosts to the feet of healthy birds. It spreads slowly, and many individuals escape it entirely, although constantly exposed to it. (Fig. 11.)

The disease is easily recognized by the enlargement of the feet and legs and the rough appearance of the surface of the feet. The parasite begins its attack in the clefts between the toes and gradually spreads forward and upward until the whole of the foot and the shank become affected. The two legs are usually attacked about the same time and to the same degree. At first there is only a slight

roughening of the surface, but the continued irritation by the mite causes the formation of a spongy or powdery substance beneath the scales, which raises them more and more until they are nearly perpendicular to the surface and are easily detached. In the most severe cases the joints become inflamed, the birds are lame and scarcely able to walk, a joint or an entire toe may be lost, and the birds, unable to scratch for food, lose flesh and die from hunger and exhaustion.

For the treatment of scaly leg it is advisable to smear the roosts with wood preserver or crude petroleum as a precautionary measure

FIG. 11.—Scaly leg.

to prevent the further spread of the disease. The uninfested birds should be isolated from the infested, and the latter should have their legs washed with soap and warm water, removing all loose scales. Dry the legs and apply an ointment containing 2 per cent carbolic acid or the sulphur ointment or Peruvian-balsam wash previously mentioned. Another good remedy well recommended is made by mixing oil of caraway 1 part with vaseline 5 parts, or the caraway oil may be mixed with 5 parts of castor oil and rubbed gently into the skin. Some poultrymen who have large numbers of birds to be treated make a mixture of one-half pint of kerosene and 1 pint raw linseed oil in a quart can, take it to the poultry house at night and

dip both legs of each affected bird into the mixture, allowing them to drip into the can for a minute after removal, and then replace the chicken on the roost. The feathers of the leg must not be wet, as this causes irritation and sometimes burns the skin. The treatment should be repeated in three or four days.

Other mites.—Several other species of mites infest poultry. One of these bores into the skin and is found in cysts lying on the under surface of the skin next to the muscles. This form is not known to do any serious injury. Another species occurs in the air passages, liver, and lungs of chickens. Unless present in sufficient numbers to interfere with breathing, it is not a serious pest. Still other mites eat the feathers of the birds, but apparently cause little injury to the birds themselves.

Chiggers, or harvest mites.—Chiggers, harvest mites, or "red bugs," which so frequently annoy campers by the intense itching they produce, may also attack fowls. Young chickens having a free range, especially if it includes low-lying land, are the most liable to suffer from these parasites. The mites penetrate the skin, causing an intense itching, and abscesses may be found where clusters of mites are feeding. These abscesses are sometimes a third of an inch in diameter, surrounded by an area of inflammation. The birds become droopy, refuse to eat, and may die from hunger and exhaustion.

If an abscess has not yet formed the inflamed area may be treated with sulphur ointment, Peruvian balsam, or a mixture of 1 part of kerosene oil with 3 parts of lard. If suppuration has occurred the scab should be removed and the area washed with 4 per cent carbolic-acid solution. Frequent light dusting with flowers of sulphur will keep the chickens from becoming infested. In the Southern and Central States, where harvest mites are most numerous, it is often necessary to keep young chickens off the range in summer. In these sections it is a good plan to hatch the chickens early in the spring, so that when the warm weather comes, in which the mites are most abundant, the birds will be old enough to resist their attacks.

TICKS.[1]

In some parts of the South poultry are commonly infested with a species of tick known as the chicken tick or adobe tick (*Argas miniatus*). This parasite when full grown may be one-fifth to one-fourth of an inch long, and is a powerful bloodsucker. In its adult stage of development it has feeding habits similar to the much smaller red mite in that it feeds only at night and spends the day hiding in cracks in the floors or walls. Pigeons are occasionally

[1] For further details concerning chicken ticks, see "The Fowl Tick," by F. C. Bishopp, Circular 170, Bureau of Entomology, U. S. Department of Agriculture.

attacked by a similar tick, and both species have been known to inflict painful bites on persons coming in contact with infested birds. These ticks, on account of their relatively large size compared with mites, can do a great deal of damage in a poultry or pigeon house, and young birds attacked by them are liable to succumb to exhaustion from loss of blood. Moreover, in the case of the chicken tick it is known that in some countries this parasite may itself be parasitized by minute organisms which are injected into the blood of the fowl which it attacks, causing a severe and usually fatal fever. In this way the tick acts as a carrier of the fever organism much as the mosquito by its bite carries the organism causing malaria to man.

The earlier stages of the chicken tick's development are passed entirely on the body, the tick leaving the birds only when it approaches the adult stage, but thereafter the adult tick attacks chickens only at night, after they have gone to roost.

Chicken ticks are very resistant, and ordinary insecticides have little effect upon them. If a chicken house is found to be infested with ticks, the chickens should be removed from it and housed in temporary coops for a period of 10 days at some distance from the chicken yard. This period of quarantine allows the young ticks that are present on the chickens to become engorged and fall off. If the chicken house is badly infested and is not of much value, it should be destroyed by burning. Otherwise, an attempt to disinfect it may be made after all loose boards and boxes which may provide hiding places for the ticks have been removed. Then crude petroleum or wood preservative may be applied as recommended for the treatment of red mites. The temporary coops in which the chickens have been quarantined should be burned or disinfected by dipping in boiling water.

A simple and inexpensive way of protecting chickens from the attacks of ticks is to suspend the roosts from the ceiling by means of small wires. The roosts are prevented from swaying by similar wires between the roosts and the walls of the house. Nests should be located away from roosting places and if constructed of metal can be disinfected quickly from time to time by burning out the straw.

Metal houses have been found to be effective in dealing with the ticks, as even without special attention they remain practically tick free, and if necessary they can be disinfected easily by a fire of straw, paper, or other light material, after removal of the roosts. Metal houses, however, are usually more expensive than wooden ones and are hot in summer and cold in winter. If they are used in summer the fowls should be provided with shade outside the house.

When ticks have once been eradicated from the premises no chickens should be added to the flock until they have been quarantined for

a period of 10 days in temporary coops, as already described. The coops should be destroyed after use, or thoroughly disinfected with hot water.

FLEAS.[1]

In the Southern and Southwestern States poultry are frequently infested by a species of flea known as the chicken, or stick-tight, flea, from its habit of remaining attached to one place. This form also attacks dogs, cats, and some wild animals. On poultry the fleas are usually found in clusters on the comb, wattles, and around the eyes; on dogs they are found on the ears. Young fowls when heavily infested often die quickly. Older birds, while more resistant, have been known to succumb to heavy infestations, and even mild infestations will reduce egg laying and retard the growth of the fowls.

As a preliminary step in the treatment for fleas all dogs and cats should be kept away from the chickens and should never be allowed to lie on the ground in the chicken yards. As rats frequently harbor large numbers of these fleas and may therefore keep up the infestation, they should be destroyed by trapping, not only on account of the fleas they may carry but because they are themselves a serious pest to poultry. Chicken fleas breed in the cracks of the henhouses, and it is accordingly necessary to treat both the birds and their quarters. The combs and wattles of the birds may be anointed with carbolated vaseline or sulphur ointment. Great care should be taken, however, not to get any of the ointment in the eyes, as it may produce blindness. The henhouses and yards should be thoroughly cleaned out, sprayed with a suitable disinfectant, and then whitewashed with lime and carbolic acid as already recommended for mites.

CROP BOUND (IMPACTED CROP).

The affection known as "crop bound" or impacted crop is an overdistended and paralyzed condition of the crop, generally caused by overeating or by swallowing coarse and indigestible substances, such as feathers. In cholera the crop is paralyzed as a result of the disease.

The first symptom is a loss of appetite or an effort of the bird to swallow without being able to do so. The crop is seen to be very large and much distended with contents which are more or less firmly packed together. If permitted to continue, the condition becomes aggravated, the breathing difficult, and death may result.

The contents of the crop may sometimes be removed by forcing the bird to swallow a teaspoonful or more of sweet oil, then massaging the lower part of the gullet if it contains food, or, if not, the part of

[1] For further details in regard to chicken fleas, see Farmers' Bulletin 683, "Fleas as Pests to Man and Animals, with Suggestions for Their Control," by F. C. Bishopp.

the crop nearest to the gullet, until a part of the contents are softened and may be pressed toward the head. This is made easier by holding the bird head downward. By continued manipulation the greater part of the material may be removed. The bird should not be permitted to eat for several hours after it is relieved.

If this plan of treatment is not successful, the crop must be opened with a sharp knife and the contents removed through the opening, using for this purpose a coffeespoon, a buttonhook, small forceps, a bent wire, or other suitable instrument. After this is done wash out the crop with clean, warm water. The opening should not be over an inch in length and should be closed with 3 or 4 stitches first in the wall of the crop and, when this is finished, an equal number in the skin. Each stitch should be made and tied separately. Coarse white silk is the best material, but if it is not at hand ordinary cotton thread may be used. Feed on milk and raw egg beaten together for a day or two, and gradually change to soft mash.

INFLAMMATION OF THE STOMACH OR INTESTINES.

Inflammation of the stomach or intestines, when not the result of one of the contagious diseases to which reference has been made, is generally due to eating moldy or putrid food or irritating mineral poisons. It is indicated by loss of appetite, dullness, and constipation, or diarrhea. It may be treated by giving 30 or 40 grains of Epsom salt or 2 teaspoonfuls of castor oil, and feeding a soft mash for a day or two.

LIMBERNECK.

The condition known as limberneck is in reality not a disease, but is a symptom of several diseases which are characterized by a paralysis of the muscles of the neck, which makes it impossible for the bird to raise its head from the ground. This condition is due to the absorption of poisons from the intestines, which act upon the nervous system and cause paralysis. It is generally associated with indigestion or the eating of moldy grain or putrid meat or with intestinal worms.

The best treatment is to give a full dose of purgative medicine—that is, 50 or 60 grains of Epsom salt or 3 or 4 teaspoonfuls of castor oil for a grown fowl. Often the birds will be cured within 24 hours. In case they are not better within 3 or 4 days it is not advisable to keep them.

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